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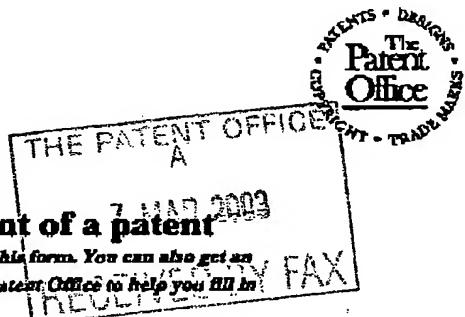
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Dated

12 January 2004

Patents Form 1/77

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1/77

Effective

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

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Cardiff Road

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1. Your reference

P/7000

07MAR03 E790581-1 D01607

2. Patent application number

(The Patent Office will fill in this part)

0305251.1

P01/7700 0.00-030525 17 MAR 2003

3. Full name, address and postcode of the or of each applicant (underline all surnames)

CNH Belgium NV
Leon Claeysstraat 3A
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Belgium

Patents ADP number (if you know it)

8399081001

If the applicant is a corporate body, give the country/state of its incorporation

Belgium

4. Title of the invention

Combine Harvester

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

A. Messulam & Co. Limited
43-45, High Road
Bushey Heath
Herts WD23 1EE

Patents ADP number (if you know it)

07636210001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country	Priority application number (if you know it)	Date of filing (day / month / year)
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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing (day / month / year)
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

No

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
- c) any named applicant is a corporate body.

See note (d))

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Continuation sheets of this form

Description

8

Claim(s)

2

Abstract

1 (D)

Drawing(s)

3

ONLY

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

1

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

John M. Alulud Co Ltd

Date

7/3/03

12. Name and daytime telephone number of person to contact in the United Kingdom

A. Messulam Tel: 020 8421 8197

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COMBINE HARVESTER

The present invention relates to a combine harvester.

5 After a crop has been cut from a field by a combine harvester, it is processed by a threshing mechanism, a separating mechanism comprising straw walkers or separating rotors, and a cleaning mechanism comprising a sieve unit to separate the grain kernels from the remainder, which is made 10 up of crop residue and chaff. The type of crop residue will depend on the nature of the crop being harvested, and the term is used herein to include such larger items as straw, stalks, corn cobs and other thick plant parts. The chaff on the other hand is much finer and includes such items as 15 husks.

It is well known, for example from WO 01/01754, for the crop residue and the chaff to be discharged separately from the rear of the combine harvester and to be processed 20 differently, the crop residue being discharged from shakers or separating rotors that are positioned above and to the rear of a sieving unit from which the chaff is discharged.

As explained in the introduction of WO 01/01754, modern 25 combine harvesters are becoming ever larger with headers or cutting tables which are significantly wider than the width of the harvester proper. For various reasons, amongst them the prevention of strips of slowly consuming crop material in a narrow path behind the machine and the risk of fire 30 resulting from the heat generated by such large combine harvesters, it is important to be able to disperse the crop residue and the chaff as far sideways and backwards as possible from the combine harvester. The spreading width should however not exceed the width of the cutting table.

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To disperse the crop residue, a chopper is provided to receive and process the material discharged from the shakers

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or separation rotors. The chopper cuts the crop residue into small pieces which are then dispersed to the side and rear of the harvester. A chaff discharging device is also provided at the discharge end of the sieving unit. The 5 chaff discharging device may comprise a blower that can disperse the chaff sideways and rearwards over a large area. The area over which the crop residue and the chaff are dispersed is preferably as wide as the cutting table so that they can later both be ploughed back uniformly into the 10 soil. It may also be required to cover the field surface uniformly in order to retain the moisture in the ground.

It is sometimes preferred not to cut the crop residue in the chopper but instead to lay strings or swaths behind 15 the combine harvester for later collection. This could be done for example with straw so that the straw may later be massed into bales or it may be done with corn cobs to avoid damaging the cutting blades of the chopper. It is also known that some corn cobs may be returned by the chopper 20 rotor against the straw hood, which thereby gets hammered and damaged.

It is therefore known to provide a deflector at the inlet of the chopper that can be set to one of two 25 positions. In the first position, the inlet of the chopper is uncovered and the crop residue flows into the mouth of the chopper so that it may be chopped and dispersed as earlier described. In the second position, the deflector covers the mouth of the chopper so that instead of entering 30 into the chopper, the crop residue falls to the ground in the gap between the chaff discharging device and the chopper forming a swath behind the combine harvester.

It has also been proposed in a co-pending US patent 35 application assigned to the present Applicants and titled "Crop Residue Spreader for an Agricultural Combine", to disperse the chaff using a spreader rather than a blower,

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the spreader being designed to be capable of spreading the crop residue as well as the chaff. With the deflector positioned to prevent the crop residue from entering the chopper, the spreader can be set in either of two positions.

5 In the first position, it allows the crop residue to fall to the ground to form a swath while in the second position it lies in the path of the crop residue so that the chaff and the uncut crop residue are together dispersed to the side and rear of the combine harvester.

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It is further known from WO 01/01754 for the chaff discharging device to have two positions. In one position the chaff falls to the ground after passing through the chaff discharge device and in the other it is ejected in a direction to mix with the flow of crop residue. Depending on the position of the deflector plate, the chaff either enters the chopper with the crop residue or is incorporated in the string of crop residue laid down behind the combine harvester.

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According to the present invention, there is provided a combine harvester having at its rear end separate chaff and crop residue discharge openings, a chopper for cutting the crop residue into small pieces, and a chaff discharge device for dispersing the chaff exiting from the chaff discharge opening, wherein the chaff discharge device is movable between a first position in which chaff can fall to the ground without passing through the chaff discharge device to lie in a string behind the combine harvester and a second position in which the chaff passes through the chaff discharge device and is dispersed laterally away from the combine harvester, characterised in that the chaff discharge device is further movable to a third position in which chaff leaving the chaff discharge device is directed to enter the chopper through an opening that is different from the opening through which the crop residue is admitted into the chopper.

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Though the prior art teaches an arrangement in which chaff leaving the chaff discharge device subsequently enters the chopper and is dispersed at the same time as the chopped 5 crop residue, the chaff is merely mixed in with the crop residue as it enters the chopper. By contrast, in the present invention, the chaff enters the chopper through a different opening and it can therefore retain its momentum 10 as it enters the chopper. In this way, the chaff discharge device is used to produce a blast containing a suspension of the fine chaff that serves to keep the chopper clean of any crop residue adhering to the blades and assists the chopper 15 in dispersing the chopped crop residue. Such effective dispersal especially is useful where larger cutting tables are used.

As in the above mentioned co-pending US Patent Application, it is preferred for the chaff discharge device to be a spreader capable of spreading not only the chaff but 20 also the crop residue and that in its second position, the chaff discharging device should lie in the path of crop residue prevented by the deflector plate from entering the chopper so that both unchopped crop residue and chaff are 25 dispersed by the chaff discharge device.

Advantageously, in its first position the chaff discharge device permits access to the chaff discharge opening to assist in maintenance.

30 The invention will now be described further, by way of example, with reference to the accompanying drawings, in which:

35 Figure 1 is a schematic representation of the rear of a combine harvester of the invention, showing the deflector plate positioned to direct the crop residue into the chopper and three alternative positions of the chaff discharging device.

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Figure 2 is a similar view to that of Figure 1 showing the deflector plate positioned to direct the crop residue forward of the chopper and the chaff discharging device positioned to spread the uncut crop residue together with the chaff, and

Figure 3 is a further view similar to that of Figure 1 showing the deflector plate in its position for directing the flow of crop residue over the top of the chopper and three alternative positions of the chaff discharging device.

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Combine harvesters are of course generally well known per se and one need not therefore be described herein in any great detail. Instead reference may be made for example to the above mentioned WO 01/01754 which shows a combine harvester in its first figure and the second figure of which corresponds to the parts of the combine harvester shown in the accompanying drawings. It suffices for the purposes of the present invention to know that the various threshers, beaters, shakers and sieves within the combine harvester separate the grain, the chaff and the crop residue from one another. The chaff and the crop residue are discharged separately from the rear end of the combine harvester, the chaff discharge opening being designated 10 in the accompanying drawings and being disposed beneath the crop residue discharge opening 12.

A discharge device 14 is mounted below the chaff discharge opening 10. The discharge device 14 is constructed as a spreader which can be used to spread either the chaff alone or the chaff and uncut crop residue over an area as wide as the cutting table of the combine harvester. The spreader is not herein described in detail as it is in itself known. The spreader may be constructed, for example, in the manner described in WO 01/01754, wherein the spreader comprises two tables with up-standing blades rotatable in opposite senses and surrounded by arcuate deflectors.

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Material fed on to the tables is spun around by the rotating tables and flung laterally and rearwards.

A chopper 16 is mounted to the rear of the chaff spreader 14. Once again, the chopper is itself well known and need not be described in detail within the present context. The crop residue is cut by the interaction of stationary and rotating blades and is then spread laterally and rearwards.

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A deflector plate 18 is pivotably mounted above on the rear of the combine harvester to guide the flow of crop residue exiting from the rear of the combine harvester.

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In the position of the deflector plate 18 shown in Figure 1, the crop residue follows the path represented by the arrow 20 into the mouth of the chopper 18. The crop residue in this position thus passes through the chopper and is cut and dispersed over the ground.

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With the deflector plate 18 in the position illustrated in Figure 1, the chaff spreader 14 can adopt one of three positions. In the position shown in solid lines in Figure 1, the chaff is spread by the spreader 14 so that both the chaff and the chopped crop residue are dispersed over a wide area. The spreader can however also be lowered into the position shown in dotted lines and designated 14a in which the chaff does not pass through the spreader 14 but falls to the ground in a string. In this second position, the spreader does not obstruct the discharge opening 10 and therefore allows access to the sieves within the combine harvester for maintenance purposes.

In a third position of the spreader 14, shown in dotted lines and designated 14b in Figure 1, the spreader is arranged to direct the chaff into a separate dedicated intake opening of the chopper 16 which is covered by a

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pivotal flap 22. When the spreader is in its position designated 14b, the flap is lowered and the chaff is blasted into the chopper 20 separately from the crop residue. In this way, the chaff is used to assist in propelling the 5 chopped crop residue to spread it over a wider area. It also prevents the crop residue from building up in any part of the chopper.

The rotation of the knife blades creates a low 10 pressure area in the chopper housing, which assists in drawing in the chaff from the spreader 14. The underpressure may be enhanced by the provision of a set of stationary counterknives at the chopper inlet and/or by a deflector above the chaff intake opening. Such deflector 15 may be constituted by a set of fingers which extend into the chopper housing and between which pass the rotating knives. Hence, the deflector also acts as a stationary shredder.

There are occasions when it is desired to spread the 20 crop residue but not to chop it because doing so would damage the cutting blades of the chopper 16. This is achieved by moving the deflector plate 18 and the spreader 14 to their positions shown in Figure 2. The deflector plate 18 in this position, prevents the crop residue from 25 entering into the chopper 16 and instead the crop residue follows the path represented by the arrow 20' to pass forward of the chopper 16 on to the spreader 14. The spreader 14 will then spread the chaff and the uncut crop residue together over a wide area.

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It would be possible with the deflector 18 in the position shown in Figure 2 to pivot the spreader to the position designated 14a in Figure 1. This should result in the crop residue and the chaff being deposited together in a 35 string as proposed in Figure 6 of WO 01/01754. In practice however, the crop residue can build up and create a blockage in the space forward of the chopper 16.

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To avoid this problem, the deflector 18 has a third position, shown in Figure 3, in which the crop residue is directed to flow over the top of the chopper 16 to fall as a string or swath behind the combine harvester. No special steps need be taken to prevent the crop residue from entering the chopper 16 as most, if not all, of the crop residue will naturally follow the path represented by the arrow 20'.

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Once again, in this position of the deflector plate 18, the chaff spreader can adopt any of the three positions previously described. Namely, in the position shown in solid lines, the chaff will be dispersed over a wide area 15 while the crop residue is laid down as a string, in the position designated 14a both the chaff and the crop residue will be deposited as strings and in the position designated 14b the chaff from the spreader will pass through the chopper 16 to clean the chopper and assist in dispersing any 20 crop residue that does enter into its mouth.

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CLAIMS

1. A combine harvester having at its rear end separate chaff (10) and crop residue (12) discharge openings, a chopper (16) for cutting the crop residue into small pieces, and a chaff discharge device (14) for dispersing the chaff exiting from the chaff discharge opening (10), wherein the chaff discharge device (14) is movable between a first position (14a) in which chaff can fall to the ground without passing through the chaff discharge device to lie in a string behind the combine harvester and a second position (14) in which the chaff passes through the chaff discharge device and is dispersed laterally away from the combine harvester, characterised in that the chaff discharge device (14) is further movable to a third position (14b) in which chaff leaving the chaff discharge device is directed to enter the chopper (16) through an opening that is different from the opening through which the crop residue is admitted into the chopper (16).

2. A combine harvester as claimed in claim 1, wherein the chaff discharge device is a spreader capable of spreading not only the chaff but also the crop residue and wherein, in its second position, the chaff discharging device lies in the path of crop residue that does not enter the chopper so that both unchopped crop residue and chaff are dispersed simultaneously by the chaff discharge device.

3. A combine harvester as claimed in claim 1 or 2, wherein, in its first position, the chaff discharge device permits access to the chaff discharge opening to assist in maintenance of the combine harvester.

4. A combine harvester as claimed in any preceding claim, wherein the opening in the chopper (16) through which

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the chaff from the chaff discharge device (14) enters the chopper is covered by means of a hinged flap (22).

5. A combine harvester as claimed in any preceding
5 claim, wherein retaining means extend into the chopper (16)
above the opening through which the chaff from the chaff
discharge device (14) enters the chopper.

10. A combine harvester as claimed in any preceding
10 claim, wherein stationary counterknives are provided above
the opening through which the chaff from the chaff discharge
device (14) enters the chopper.

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ABSTRACT

COMBINE HARVESTER

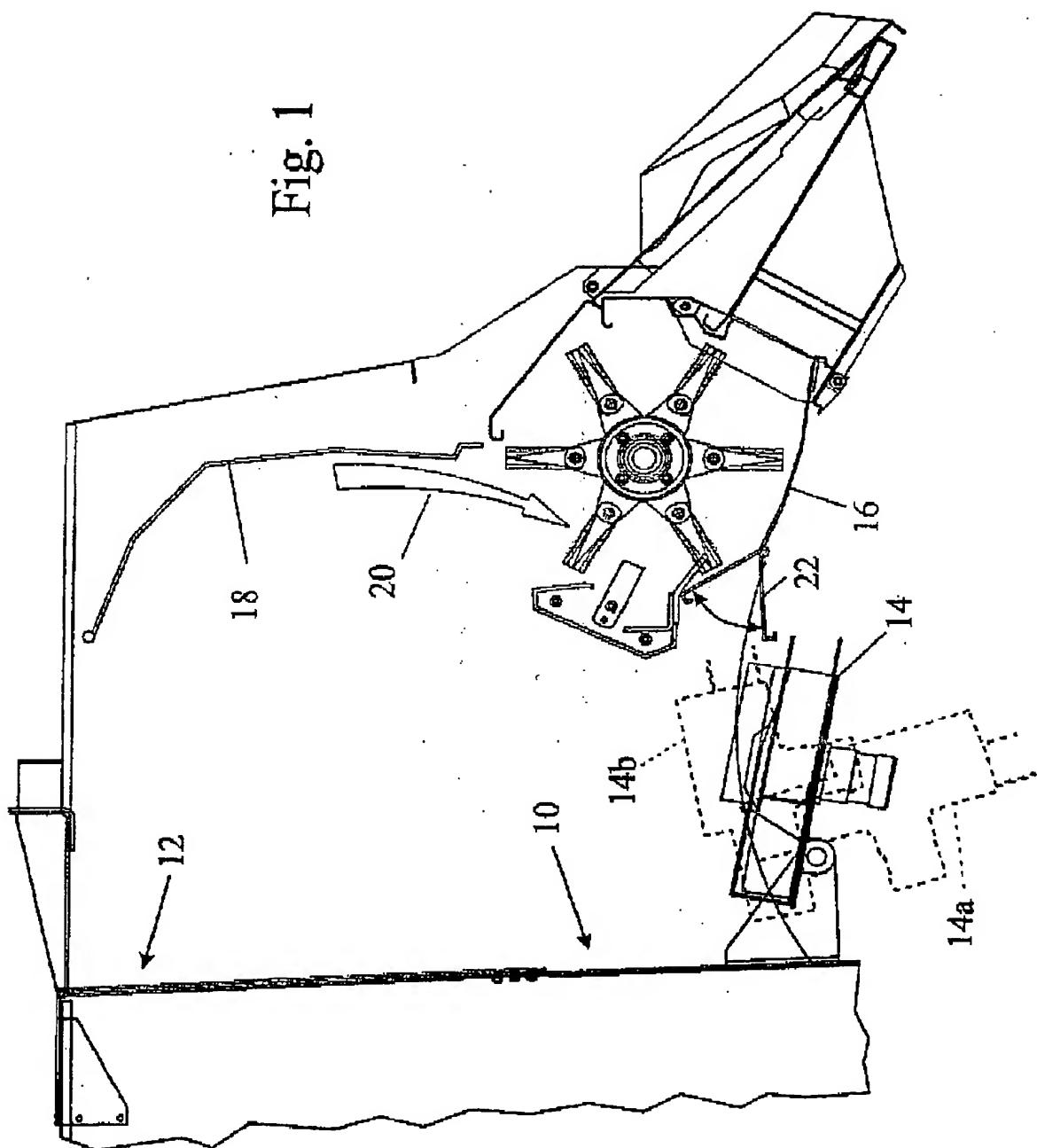
5 A combine harvester has at its rear end separate chaff (10) and crop residue (12) discharge openings. A chopper (16) is provided for cutting the crop residue into small pieces, and a chaff discharge device (14) serves to disperse the chaff exiting from the chaff discharge opening (10). The 10 chaff discharge device (14) is movable between a first position (14a) in which chaff can fall to the ground without passing through the chaff discharge device to lie in a string behind the combine harvester and a second position (14) in which the chaff passes through the chaff discharge 15 device and is dispersed laterally away from the combine harvester. The chaff discharge device (14) is further movable to a third position (14b) in which chaff leaving the chaff discharge device is directed to enter the chopper (16) through an opening that is different from the opening 20 through which the crop residue is admitted into the chopper (16). In this way, a blast from the chaff discharge device (14) carrying the chaff acts to keep the chopper (16) clean and assists it in dispersing the crop residue.

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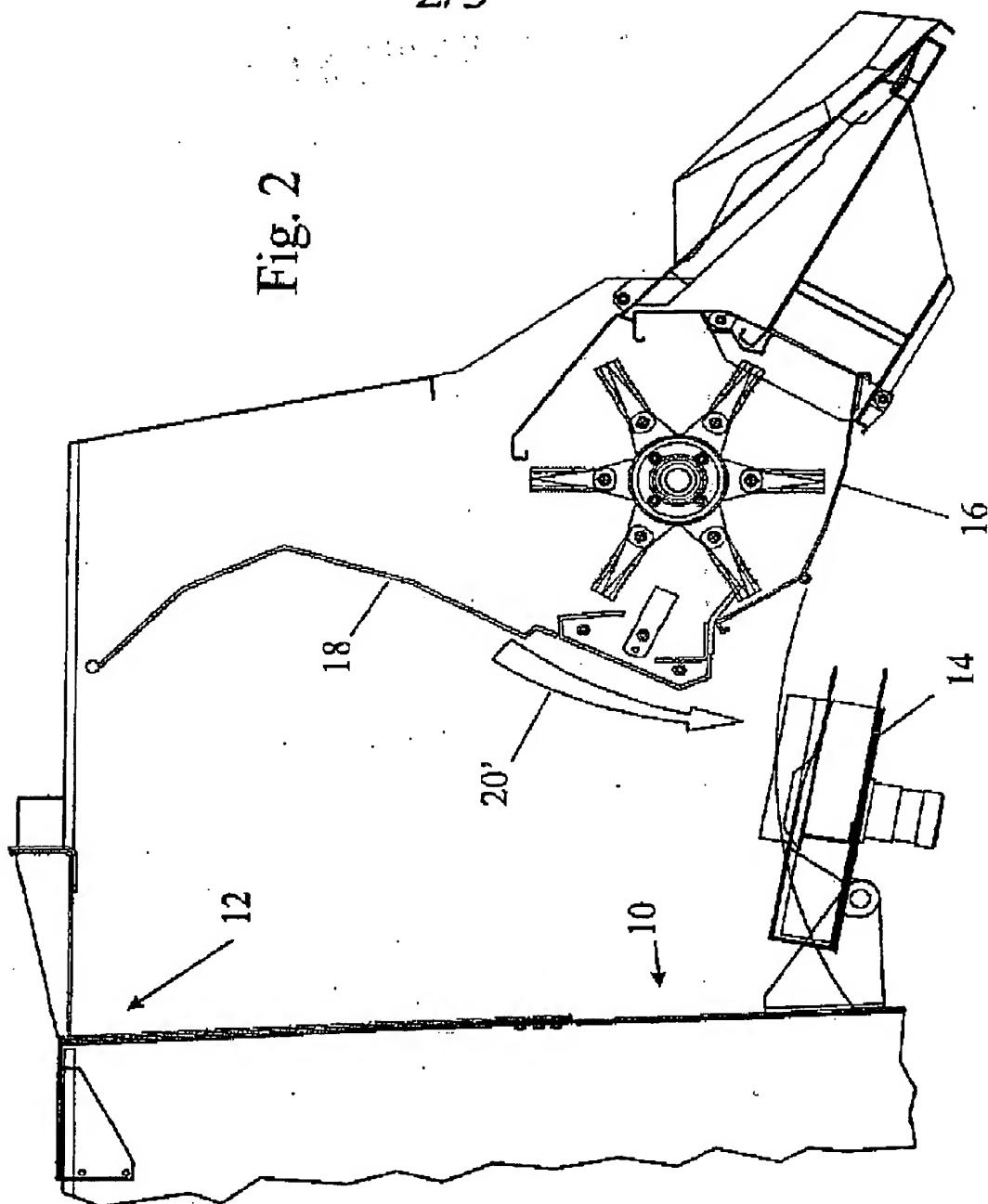
Figure 1

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Fig. 1



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Fig. 2



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Fig. 3

